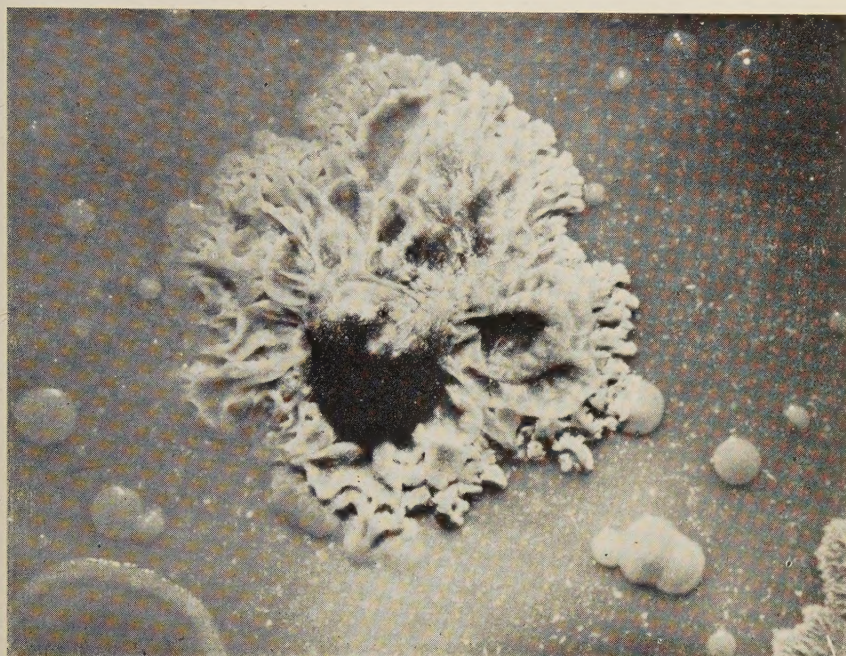


PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA



NEW SERIES NUMBER TWENTYFIVE

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Price
50 Cents



July
1956

R R I

LOCATION. The institute's laboratories and offices are at the third mile, Ampang Road, Kuala Lumpur.

CORRESPONDENCE. All LETTERS must be addressed to the Director, Rubber Research Institute of Malaya, Post Office Box 150, Kuala Lumpur. Special inquiries may be marked for the attention of particular officers. The address for TELEGRAMS is Searching, Kuala Lumpur. TELEPHONE: Kuala Lumpur 3351. PARCELS occasionally arrive without any indication of their origin. Senders' names and addresses should be written clearly on the outside of all packages, and the institute should be advised of despatch by letter or telegram.

PROHIBITED PLANT SPECIMENS. Attention of planters and others in territories outside the Federation of Malaya and the Colony of Singapore is drawn to the Malayan Plant Importation Rules which prohibit the importation into Malaya of any part of a plant, whether living or dead, unless it is accompanied by a permit issued by the Director of Agriculture, Federation of Malaya. No permit will be issued in respect of any diseased plant or any plant pest. Any plant imported in contravention of these Rules (whose object is to prevent the introduction of diseases or pests) will be destroyed without examination. Anyone outside Malaya who desires our advice on any matter that may require examination of living material must first inquire by letter.

ADVICE. Inquiries are invited from rubber producers in the Federation of Malaya, the Colonies of Singapore and North Borneo, and the territories of Sarawak, Brunei and Nigeria, who may require more detailed information applicable to their own special problems. Where it is considered necessary, visits will be made to Estates in Malaya as convenient. Visits to estates in other territories are by special arrangement. The only visits for which charges are normally made are those of the Institute's budding mandores. INTERVIEWS should be arranged by letter or telephone, as members of the senior research and advisory staff are frequently absent on visits to plantations. The institute is open from 8 am to 1 pm and 2 pm to 4 pm on Mondays to Fridays, and from 8 am to 12.30 pm on Saturdays.

EXPERIMENT STATION AND FACTORY. This station of the R R I is situated 16 miles from Kuala Lumpur, at Sungei Buloh on the Kuala Lumpur—Kepong—Kuala Selangor road. Visits may be made on Mondays or Wednesdays by arrangement. There is a guest house.

PUBLICATIONS. A list of 'Publications of the R.R.I.' is available on request. Subscription may be made by depositing \$15 with us. An annual statement of account will then be submitted.

PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA

Kuala Lumpur

July 1956

Number 25

Editorial: Chemical Advisory Service

We are often surprised to learn that planters, estate owners and even company executives are not always aware of the scope of the advisory service provided by our Chemical Division. This service covers all problems encountered from the time natural rubber leaves the tree until it reaches the consumer's factory.

Consider latex collection: pre-coagulation may occur, adulteration may be suspected, the anticoagulant used may suddenly prove to be ineffective. Or it may be in processing the crop that troubles occur — too rapid coagulation, difficulty in machining, discoloured patches, bubbles in sheet, and a host of other minor defects. Many problems arise in latex concentrate production which are often difficult to trace but with which we can deal because we have laboratory facilities enabling us to make systematic investigations. Problems with baling and packing dry rubber, drumming and shipping latex concentrates, fall within our scope as well as the broader issues involved in design of drying houses, factory machinery and layouts, and so forth. We will also assist in the setting up of your own laboratory and in demonstrating methods of test to your staff. We are often able to help with these problems because over the years we have benefited from the experience of many estates and have carefully garnered the information.

The Chemical Division advisory service is in the charge of one officer, Mr J.E. Morris, and all enquiries are routed through him. He brings to your problems a broad general knowledge of rubber production and processing, but no man can be an expert in all things. The Advisory Officer is in daily touch with specialist officers in the Division, ranging from the Chemical Engineer to the Bacteriologist. When specialised information is required Mr Morris consults with his colleagues before a considered reply is despatched. In this way we ensure that research findings have been passed through the ordeal of practical trial before they are recommended for use in your estate or factory. This we consider to be a very important stage and we earnestly request that you help us in this respect by addressing all your written enquiries to the Director, marked 'for attention, Head of Chemical Division', and particularly by ensuring that telephone calls and personal visits are made to either the Head of the Division or Mr J.E. Morris (in his absence, Mr G.W. Drake). We are always happy to welcome you at the Institute to discuss problems but please telephone beforehand and make an appointment, otherwise your journey may be in vain. We are also glad to make visits to estates and factories, but such visits are time consuming and we ask for your indulgence if we sometimes delay a little to assist officers in planning tours.

No charge is made for any of the above services. We do, however, make a nominal charge when our laboratory services are called upon for purposes of routine testing such as d.r.c. of field latex, properties of latex concentrate, or analysis of chemicals used in rubber preparation. We are at all times at the service of the rubber producers of Malaya but we do not know what your special problem is unless you tell us about it.

Is Mature Rubber Undertapped?

WHEN A RUBBER TREE IS TAPPED, latex is withdrawn from an area of bark situated mainly below the tapping cut. This is a generally accepted theory. After the flow has stopped, rubber regenerates in the area of bark from which latex has been extracted, so that when the cut is reopened a fresh flow of latex takes place. The extent of bark which contributes latex depends on the yield capacity of the tree; for high yielding trees it may be as much as five feet below the cut, but for old unselected seedlings it rarely exceeds a distance of three or four feet down.

Our older trees, budded and seedling, are usually tapped on a half circumference cut at intervals of two days ($C/2 \cdot d/2 \cdot 100\%$ system). An increase in frequency of tapping is known to lead to a high brown bast incidence, especially for seedlings. A completely different proposition, however, might be to tap on two cuts in such a way that the areas of bark from which latex is extracted do not overlap. These two cuts would need to be at least four feet apart, or more if possible. An additional safeguard would be to have the two cuts on different sides of the tree.

If these conditions are fulfilled we can perhaps consider the tapping of the two cuts as two separate tapping procedures, with the major advantage that a larger area of bark is mobilised for rubber production. This suggests that good mature trees able to stand ordinary half circumference alternate daily tapping might instead be tapped on two well separated cuts at alternate daily intervals, and that similar trees which can only be tapped third daily might be tapped third daily on two cuts also. The proviso is that the cuts be far enough apart to avoid overlapping of the areas of latex extraction, otherwise a high incidence of brown bast might be expected.

Since a tree is an individual and one physiological unit, the idea of splitting it into two separate areas for rubber production is artificial. On the other hand the rubber tree is not intended by nature to be tapped at all, so that the assumption that local wounding (tapping) results in only a local reaction of the bark (latex flow) may well be correct. We have tested this hypothesis in a few experiments on older trees, and we are planning other experiments on younger material.

PROMISING RESULTS WITH OLD TREES

An Experiment with Clones — We are studying the reaction to double cut tapping of old budded trees whose yield had dropped when tapped on bark of second renewal. Second cuts were opened high, at

Is Mature Rubber Undertapped?

90 inches above the union when the original cuts were at 35 inches above the union, the latter cuts being in bark of second renewal. Both cuts of the double cut tapping system are tapped on the same days.

Over a period of eighteen months the trees in this experiment have more than doubled their yield as a result of the 2C/2 . d/2 . 200% system. The major contribution to this high yield level has been from the high cuts. Interesting trends appear in *Figure 1*, which shows the mean monthly yields throughout the experiment. The double cut tapping results are in red (total, and for upper and lower cuts separately), while yield on the original single cut — continued on control plots — appears in black. A further comparison is given by the results for trees tapped only on a high cut (blue).

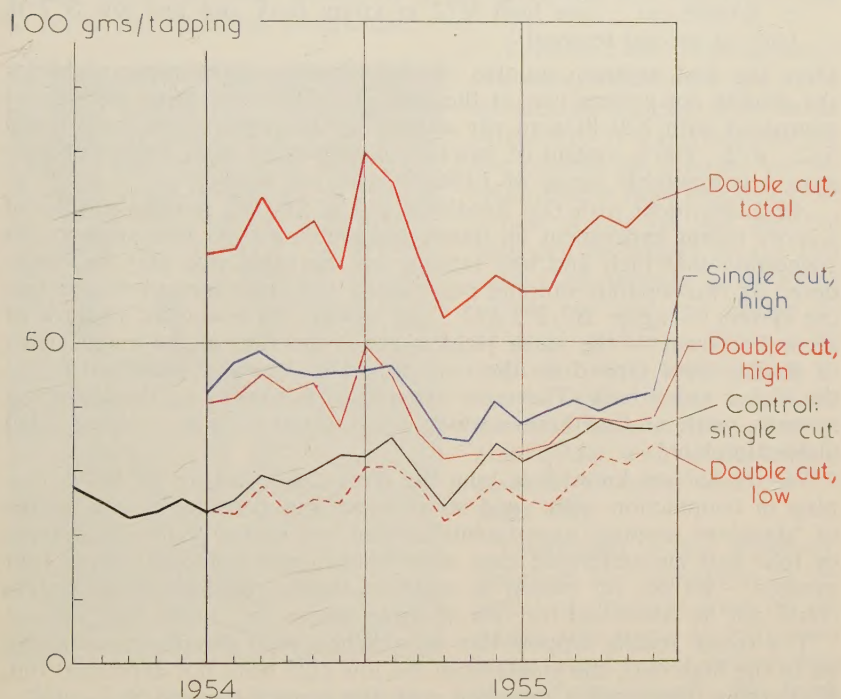


Figure 1. Double cut experiment on old budded trees. All trees were being tapped S/2 . d/2 . 100% until June 1954, when experimental tapping commenced. See text.

The trend of the high cuts is to decrease slightly, probably because they gradually approach the junction of the virgin bark with the thin renewed bark. Many of the latex vessels in the virgin bark discontinue at this junction and a decrease in yield is commonly observed when a tapping cut moves towards such a barrier. The slowly increasing yield of the cuts tapped in bark of second renewal shows that the high and low cuts do not compete. Unfortunately the figures are not strictly comparable because in this experiment only one ninth of the total number

Is Mature Rubber Undertapped?

of trees is tapped on the double cut system—the remainder are equally divided between the two single cut systems. Nevertheless the high cuts of the 2C/2 . d/2 . 200% system clearly show a pattern of trend similar to the high cuts of the single cut system, and the same is true with respect to the low cuts.

The above experiment is being carried out on our oldest clone trial, in which nine clones were compared in four replications. The age of the trees is 26 years. For the new experiment, each plot of the original trial layout has been divided into three subplots which are tapped alternate daily on the following cuts, respectively:

a control : low S/2 in bark of second renewal.

b high cut : V/2 in virgin bark,

c double cut : one high V/2 in virgin bark and one low S/2 in bark of second renewal.

Over the first eighteen months of the experiment the mean yield for the double cut system was at the rate of 1,740 lb/acre per annum, as compared with 820 lb/acre per annum for the control on the original S/2 . d/2 . 100% system of tapping. The trees on high single cut only gave a comparable figure of 1,080 lb/acre per annum.

An Experiment with Old Seedlings—The first six months' results of a more recent experiment on unselected seedling trees also support the suggestion that high and low tapping on the same tree may be considered as two separate tapping procedures. For trees tapped on the two cut system — again 2C/2 . d/2 . 200% with the lower cut in bark of second renewal — the mean yield is about the sum of the mean yields of similar trees tapped on the one cut, (i) in renewed bark and (ii) in the higher virgin bark. The same experiment is comparing these tapping systems, with and without various applications of our recommended yield stimulant*.

We do not yet know how long the trees can stand up to 200% tapping in conjunction with yield stimulation, but considering the results of 'slaughter tapping' experiments carried out earlier—in which three or four half circumference cuts were treated with stimulant every four months—we see no reason to suppose that a relatively mild system could not be continued for two or three years.

The recent results support this view. When yield stimulant was applied to the high cuts, the yields from the low cuts were not depressed but, if anything, increased. Compared with the control (tapped S/2 . d/2 . 100% on bark of second renewal without yield stimulation) a relative yield of 225% was obtained on the double cut system when stimulant was applied below the high tapping cut at six monthly intervals. For monthly application of stimulant above the high cut, the comparable yield was 230%. Treatment of the two tapping cuts at the same time may prove too drastic; relative yields of 255% (stimulant below both cuts, half yearly) and 234% (stimulant above both cuts, monthly) were obtained. Alternate applications to high and low cuts, at intervals of three months, are being observed with special interest and have given a yield of 261% relative to the control over the six months of the experiment.

* 'Yield Stimulation with 2,4,5-T', *Planters' Bulletin* 19, page 75

PRACTICAL RECOMMENDATIONS

At this stage of experimentation we do not intend to supersede the recommendations we have given in the articles under the heading 'Tapping Prior to Replanting', which appeared in *Planters' Bulletin* 15 and 22. However, early results together with our prior knowledge of the subject do suggest that the double cut alternate daily tapping system, as described in this article, may well prove to be commercially sound as a relatively longterm tapping proposition, possibly even in conjunction with the use of a yield stimulant, on rubber over eighteen years of age. An estate in Kedah has achieved yields exceeding 1,200 lb/acre per annum from old unselected seedlings over a period of more than a year, using the latter system. It is not surprising that this estate had to revise its replanting programme.



Figure 2. Double cut tapping in progress. The X form ladder suits any girth of tree.

Whilst we are making no recommendations until we have discovered the long term effect of the double cut system, both with and without the use of stimulants, we do believe that estates would be justified in trying out such systems on a small scale to determine the effect for themselves and to investigate task sizes. We again emphasise that the system should only be tried on older trees, at present.

Our Botanical Division will be pleased to hear from estates interested, and to inspect the practical results of systems tried out.

Tapping Task — The layout of our experiments does not allow an accurate estimate to be made of the size of a tapping task for the double cut system, but we think that a high proportion of a task tapped on one high cut only can be tapped on the two cuts. High tapping is apt to be rough, but can and should be of good quality — there is no need for bark consumption to exceed twelve inches a year, on alternate daily tapping. A suitable ladder with a platform is essential (*Planters' Bulletin* 15; page 104).

Conclusion — In summary, therefore, the hypothesis of the extent of drainage areas on the rubber tree seems to have been borne out by the early results of our experiments. We think that the importance of these results justifies this early release of information to the industry

Cleanliness in the Factory—

Self Sterilising Surfaces

NEW METHODS FOR CLEANLINESS IN THE FACTORY were anticipated in an Editorial a year ago, and our investigations have now led to specific recommendations. The article 'Life in Latex' which appeared in *Planters' Bulletin* 19, described the rapid growth of bacteria in latex, in ammoniated field latex, and even in fully ammoniated latex concentrate. Many of these bacteria can now be identified precisely, and not only so, but we have a good idea of the stages at which individual species enter the latex.

Why 'factory bacteria' — When we consider commercial latex concentrate which has been fully ammoniated, to the level of 1.65 % to 1.9 % on the water phase, it is clear that only those bacteria which can resist this concentration of ammonia will be able to harm the latex during shipment overseas and in subsequent manufacture. Under what conditions are these species bred? Such resistant bacteria develop in the factory, where there is continuous contact with high ammonia concentrations, rather than in the field and at the collecting station, where the concentrations are lower. They are 'factory bacteria'.

If the factory were ideally sterile, that is free from all viable bacteria, and if this ideal condition could be re-established after each passage of ammoniated field latex to the concentrate stage, then the number of bacteria truly resistant to ammonia would be negligible. Deterioration of latex concentrate in transit to the consumer would then be much less prevalent.

What is called for, therefore, is an onslaught on the high populations of bacteria in the factory. There are two main lines of attack — one at the immense concentration of bacteria in sludge and in coagula, the other at the dirt throughout the factory installation as a whole. For the former, which applies particularly to the dead spaces of pipelines, the recommended action is to remove the coagulum, to scrub the surface thoroughly, and finally to cleanse vigorously with a bactericidal detergent wash which is compatible with latex — this is especially necessary where water supplies are prone to bacterial infection. Several washes have been tested bacteriologically in our laboratories and are now undergoing factory trials.

The second line of attack — the general — is perhaps more difficult, and for this purpose we recommend self sterilising surfaces.

What is a self sterilising paint? — We have recently tested a self sterilising paint which has been used successfully in British hospitals. It might be thought that any paint could be made to provide a self sterilising surface when dry, simply by incorporating a bactericide (or fungicide) before use. This is not so, for while the paint surface may itself be protected from attack, the rate of growth of bacteria nearby may be unaffected. A self sterilising paint may be sensibly defined as one which provides a porous surface from which a potent bactericide slowly diffuses. To be effective, such a surface must not only resist attack, but must also inhibit the growth of micro-organisms nearby, over a long period.

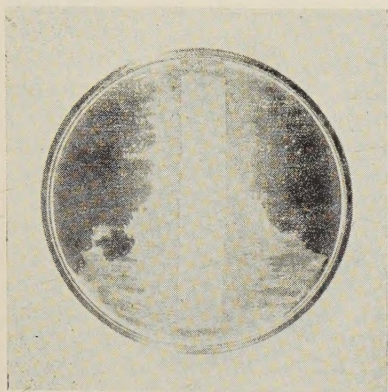


Figure 1. Inhibition of two bacteria by the paint. One, *Serratia marcescens*, is a common cause of a 'spot disease' of crepe; the other, a *Streptococcus* species, destabilises latex and survives ammoniation.

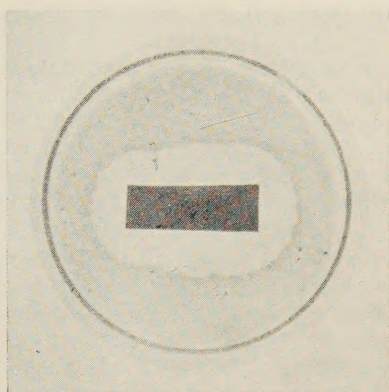


Figure 2. Antibacterial action of a paint strip against two strains of a *Bacillus* species, which were isolated from a rail tanker. The tanker had been steam cleaned twice and treated with formaldehyde.

Figures 1 and 2 show typical effects of self sterilising paints in our tests; bacterial growth was completely inhibited up to about half an inch from the paint surface for most species. For a test, each circular glass dish holds a layer of special jelly, which is ideally prepared for breeding bacteria. The surface is uniformly seeded with something like ten million bacteria — sometimes in sections for different species — and in the centre is the paint strip, fully cured. The plate is incubated at the best temperature for the bacteria to multiply, and again they have every chance to overcome the antimicrobial action.

Figure 3. Antifungal action of two grades of the recommended paint. The fungus is an *Aspergillus*.

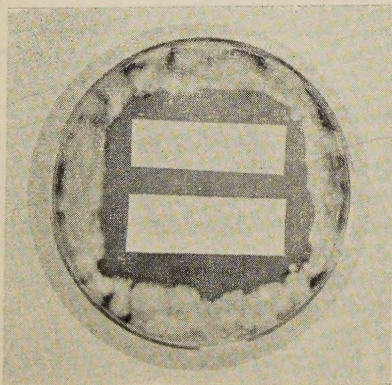
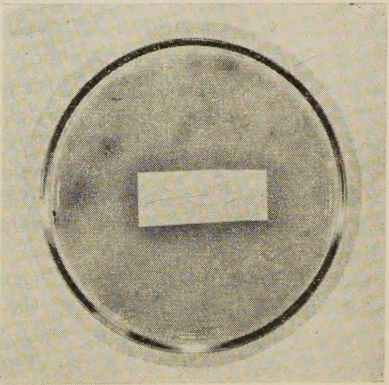


Figure 4. Inhibition of the mixed bacterial population of fresh latex (diluted 1 : 10,000). The dark halo (of purple) around the paint strip is an alkaline region, in contrast to the rest of the plate (yellow), which is acid.



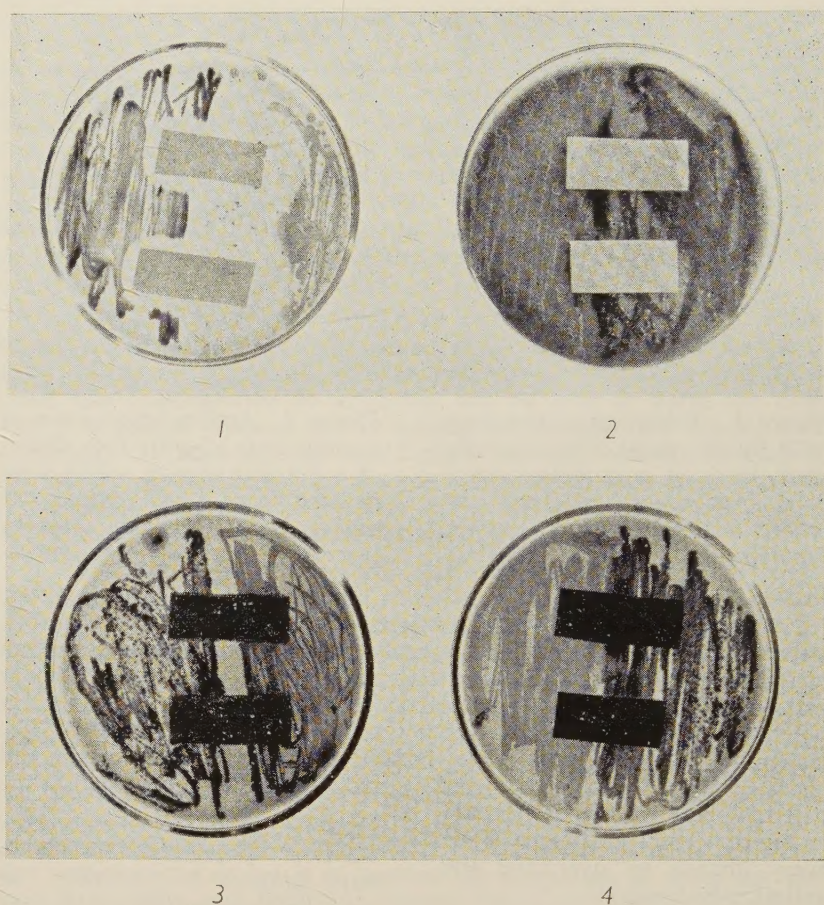


Figure 5. Four commercial paints compared; only the first shows inhibitory properties.

1 – The recommended grades

2 – An aluminium dispersion

3 – A bitumen paint

4 – An alkali resistant paint

Technical apology : the seeding in this trial was not uniform

The manufacturers of the paint which we recommend claim that the self sterilising action was retained under industrial conditions after eighty washings and eight months ageing; they have since extended their large scale trials to a year with thoroughly satisfactory results. In metal urinals the paints showed no deterioration after eighteen months and had completely arrested the formation of obnoxious odours.

There are two commercial grades of this paint; their action against fungi is illustrated in *Figure 3*. The two grades have similar bactericidal

Cleanliness in the Factory

properties, and the choice between them depends on the need to combat fungi.

A self sterilising paint surface is to some extent porous, to permit the diffusion of the bactericide. Because of this the metal surface beneath requires protection against corrosion — iron from rust, or aluminium from alkaline attack. The paint surface itself is not attacked. As an undercoat for iron which is not in contact with alkalis, we recommend a red lead primer. Where there is direct contact with alkalis, especially ammonia vapour, an alkali resistant paint is the best undercoat.

Factory managements are now well aware that brightly coloured surfaces are kept clean while those in dull colours or black are seldom cleaned at all. Self sterilising paints come in a range of colours, with a gloss surface if required. Bright colours are psychologically a strong incentive to keep factory equipment clean. The manufacturers supply a special wash for cleaning the paint surface; this is a concentrated solution of a quaternary ammonium salt which is a powerful bactericide. Unfortunately this type of compound destabilises latex and latex concentrate, and should only be used where factory supervision is good enough to ensure that it does not enter the latex.

We shall be pleased to advise, in the light of our tests to date, on the choice of self sterilising paints and undercoats. Many such paints could be devised — those we recommend happen to be consistently successful and readily available. Of six other commercial paints we have examined, five had no self sterilising action as defined above, and one gave such variable results, both with respect to the species inhibited and to the duration of the effect, that no positive conclusion could be drawn.

As yet, we can recommend no self sterilising surface for use in direct and permanent contact with fully ammoniated latex concentrate, for the interior of drums, rail tankers, and ships' tanks. This implies no deficiency in the paint — our trials are incomplete and we hope to meet this requirement eventually.

Mouldy Rot

This article supersedes another of the same title which appeared in Planters' Bulletin 6, now out of print. A new list of approved fungicides is included.

MOULDY ROT DISEASE OF THE TAPPING PANEL causes considerable damage throughout Malaya, particularly during the wet season. If left untreated, the damage may be so severe that renewed bark is unfit for tapping. Prevalence is greatest in areas where the atmosphere is continuously damp, owing to the lie of the land, close planting, or density of the undergrowth. Because the causal fungus is unable to survive in conditions of low humidity, the attack usually passes with the advent of dry weather.

Symptoms — The first indication of the disease is the appearance just above the tapping cut of a series of slightly depressed discoloured spots, which later darken and become covered with a greyish mould. The subsequent enlargement of these spots leads to the formation of an

Mouldy Rot

Tapping panel with large areas of bark destroyed by untreated mouldy rot.

irregular band of infection running parallel to the cut. The progress of infection is rapid and as the soft bark tissues are destroyed, wounds exposing the wood may be developed within a few weeks. In general appearance these wounds resemble those produced by bad tapping.

The Causal Fungus—This is *Ceratostomella fimbriata*, a fungus with an olive brown mycelium that gives rise to three kinds of spore:
i Colourless thin walled cylindrical spores, produced in great profusion on the surface of the newly tapped bark, and chiefly respon-



sible for the characteristic mouldy appearance of infected panels.

ii Olive brown thick walled spherical spores formed in relatively small numbers either on the surface of the bark or within the diseased tissues; these enable the fungus to survive periods of dry weather.

iii Colourless thin walled spherical spores, produced in black flask shaped bodies; these are rather rare.

Another fungus, a species of *Fusarium*, is not uncommonly found in association with the *Ceratostomella*.

Spread of the Disease --- The disease is spread mainly through the agency of tapping knives and clothing contaminated with spores, though insects in air currents undoubtedly take part in its more local dissemination.

PREVENTION

As the fungus is unable to infect anything but newly tapped bark, outbreaks of mouldy rot in areas particularly liable to attack — because they are low lying or adjacent to infected fields — may be prevented by resting the trees during the wet months.

On the other hand, since the disease is so dependent on humid conditions and the slow drying of tapping panels for its development, it is often possible even under continued tapping to prevent it appearing in a susceptible area by keeping the undergrowth well under control during the whole of the wet season. As a further precaution it is desirable to avoid the introduction of the disease on infected tapping knives or clothing; this means that tappers should not be employed in a healthy area alternately with an infected one.

Mouldy Rot

CONTROL

The results of our experiments convince us that the control of mouldy rot is a perfectly feasible operation, provided that the better fungicides are used and applied sufficiently frequently. Treatments with aqueous preparations at weekly or longer intervals are little better than a waste of money, as they are most unlikely to secure control. Applications of lime, or of cowdung and clay, do not cure the disease but merely obscure it.

First it is necessary to cut back excessive undergrowth in the infected fields, then to treat the panels with the fungicide selected. A list is given below of preparations officially approved for the treatment of mouldy rot; against each is shown the source of supply in Malaya and the standard packing sizes. The concentrations at which they should be applied are also given, and where there is a range it is advisable to start with the lower strength; if this fails to secure control the concentration can be increased, but the stated maximum cannot be exceeded without danger of bark burning

<i>Name</i>	<i>Agents</i>	<i>Standard Packings</i>	<i>Recommended Concentration</i>
Agrisol	Sime, Darby & Co	1, 5 gal	15 — 25%
Agrisol White (Vulcan)	Sime, Darby & Co	1, 5 gal	5 — 10%
*Agrisol Vulcan Red	Sime, Darby & Co	1, 5 gal	5 — 10%
Black Cyllin	Sandilands Buttery & Co	5 gal	5 — 10%
*Brunolinum Plantarium R.I. (Red Improved)	James Warren & Co	1, 5 gal	10 — 15%
Cargilineum Mixture	Boustead & Co	40 lb tin	neat
*Fylomac 90	Imperial Chemical Industries (Malaya)	1, 10 lb	0.28%
Ialine White Disinfectant	Harrisons & Crosfield (Malaya)	1, 5 gal	5 — 10%
Izal	Guthrie & Co	1, 5, 10 gal	3 — 5%
Killgerm	McAlister & Co	5 gal	5 — 10%
*Kilsol Red	Kyle, Palmer & Co	1, 5 gal	5 — 10%
Paragerm	Lindeteves (Malaya)	40 gal	5 — 7½%
White Septol	George Blunn & Co	1, 5 gal	5 — 10%

All but two of the materials in the above list are water miscible tar acid fungicides; the exceptions are Fylomac 90, a water soluble synthetic material, and Cargilineum Mixture, a tar product that is water repelling. The list differs from that published in *Planters' Bulletin* 6 in that two materials have been dropped and four added. Ialine Ordinary Disinfectant has been withdrawn by the manufacturers, leaving Ialine White Disinfectant on the list. Brunolinum Plantarium has been replaced by Brunolinum Plantarium R.I. (Red Improved). The three other additions are: Agrisol Vulcan Red, Agrisol White (Vulcan), and Cargilineum Mixture.

The importance of the water miscible tar acid fungicides led the Rubber Research Institute to finance a three year programme of work

* indicates that a dye has been incorporated by the manufacturer to facilitate supervision in the field.

at Long Ashton Research Station, Bristol, England, designed to identify the fractions that give the coal tar mixtures fungicidal properties. The results of this work are being published as Communication 299 of the *Journal of the R.R.I. of Malaya*, which includes a description of the method of testing on which we have based our recommendation to the Department of Agriculture to place a new product on the approved list. The knowledge that has been gained at Long Ashton will be used to maintain a high standard of effectiveness of the approved materials, and to simplify the testing procedure.

Methods of Application of the Fungicides — For application of the aqueous materials we recommend spraying in preference to painting, both for the increased facility of the operation and for improved coverage. In our experience it has also worked out rather cheaper. The spray should be directed so as to apply the fungicide over a broad band two thirds above the cut and one third below. If a brush is used, the first two or three applications should be made over a band extending four or five inches above the cut; thereafter treatment may be confined to the most recently tapped two or three inches of bark, the lower limit of the painted strip being as near to the cut as possible.

The preference for spraying assumes that sprayers of suitable design are available. From trials with a number of different types it has been concluded that what is needed is a fine spray at a low rate of delivery (less than $\frac{1}{2}$ pint per minute) in a narrow cone (6 inches diameter one foot from the nozzle). To avoid overfrequent filling in treating large areas the sprayer should have a capacity of $1\frac{1}{2}$ to 2 gallons, held in a knapsack container. Where the container is pressurised, the trigger in the spray lance should be of the type that discharges when it is depressed and closes when released.

Cargilineum Mixture should be put on as a thin smear above the tapping cut. To attain an even coating it must be applied when the bark is dry, and it may need first to be gently warmed in the sun.

Number of Applications of the Fungicide — The number of applications required to bring the disease under control will depend on prevailing weather conditions, effectiveness of the fungicide, and whether or not the trees are in tapping. To bring the disease under control while tapping is continued, using one of the aqueous materials, all trees in an infected task should be treated after every tapping. Up to twelve applications may be needed. Under the alternate daily system it will probably be found most convenient for treatment to be made on the day following tapping, so that the labourers doing the work can put in a full day. A day's delay in applying the fungicide is not as serious as it might seem, for with good tapping much of the cut is effectively protected by the scrap. As this must be removed before treatment is applied, the labourer's time will be saved if scrap collection is done by a podian who goes ahead of him.

Cargilineum Mixture is more difficult to apply than the water miscible fungicides, but it has the advantage of not being washed off. Further applications are still needed to protect bark newly exposed by the tapping knife. It is suggested that it be applied once every fourth day to fit in with an alternate daily or fourth daily tapping schedule, or every sixth day on a third daily schedule.

Systematic Eradication — As mouldy rot is a disease confined to the tapping panel of the rubber tree, it is feasible to eradicate it from an area by an organised campaign in which all affected trees are treated within a few days of each other so that sources of new infection are eliminated. The way in which we think sprayers should be used to deal with an extensive outbreak is illustrated by the plan given below, drawn up to deal with 700 infected acres by employing eight pneumatic hand sprayers — sufficient to treat 120 acres a day — the whole campaign being completed in about three months.

i Cut back the undergrowth throughout the area.

ii Concentrate the eight sprayers on cleaning up 240 acres by alternate daily treatment.

iii On completion of (ii), detach two sprayers to work through the 240 acres and treat any new cases that appear, concentrating the remaining six on alternate daily treatment of a further 180 acres.

iv When the second area has been cleared up, detach two sprayers to work through it and concentrate the remaining four on alternate daily treatment of a further 120 acres.

v By the time the last area has been cleared up there will remain about 160 acres to be treated. At this stage it should be possible to bring in two or three of the roving sprayers from the first treated fields and clean up the area in one further alternate daily operation.

Reducing Tapping Intensity — Experience gained over many years, under the most adverse conditions, has shown that it is feasible to control severe mouldy rot without interfering with tapping. However, there may be situations where the regular rounds necessary to do this cannot be maintained. It may then be considered whether the trees should be tapped less frequently, for the incidence of disease on trees tapped every third day is lower (every fourth day lower still) than on trees under the usual alternate daily system. On the other hand, if the trees are tapped on a periodic system it may be possible to arrange for fields that are known to be liable to infection to be those which are rested during the wet season. Treatment will then quickly bring the disease under control, but it should be repeated after each of the first two or three tapplings on reopening the cut, to prevent spores present in the untapped bark from starting fresh infections. Opening a new cut a few inches below the old one is not advised if the panel is to be re-tapped, for the subsequent yield of the renewed panel may be adversely affected.

Additional Precautions — If the disease has been particularly widespread or unusually intractable it will be advisable to continue treatment after control has been obtained, with application following every third or fourth tapping day so long as wet weather lasts.

All knives, bags for carrying scrap, and other utensils used in infected areas, should be disinfected by immersion in a solution of the fungicide.

Excessively deep tapping is generally held to favour the incidence of mouldy rot and should therefore be avoided.

Supervision — To assist supervision, the solution of a fungicide that does not already contain a dye can be coloured by adding methylene blue at the rate of one ounce to ten gallons.

Spray Painting Bales

We have pleasure in presenting a guest article from the Technical Branch of Socfin Company Limited.

FOR SOME TIME AFTER THE WAR considerable criticism was levelled against natural rubber producers on account of inadequate and careless packing. Socfin bales had been well received for many years, particularly in the United States of America, and our method of preparation was therefore offered through the Rubber Research Institute for the general information of other producers and packers. The Institute published the data in August 1951 as a manual entitled *Socfin Method for 'Naked' Baling of Rubber*.

The Rubber Manufacturers Association of America subsequently made it mandatory for producers to use a bale paint consisting of a suspension of talc in a mineral turpentine solution of rubber. Modification to the paint described in the manual was therefore necessary, and improvements have been made both to the material and in its application. The following brief account of the manner in which Socfin bale paints are currently made and used brings the manual up to date, and will be of interest to those who have found it of assistance.

Method of Application—Suspensions of talc in mineral turpentine solutions of rubber can be made with a wide range of viscosities. It was therefore appropriate, when changing from the paint originally described, to consider the practicability of a compound for application by spray gun rather than by hand painting. Several advantages can be expected:

A smooth even white surface on the bale, without excess loose talc.

Elimination of hard aggregates of dried compound at the joints of the wrapping sheets.

An economy in both labour and material.

A higher standard of cleanliness in the packing shed, achieved by avoiding the use of all talc in the form of powder.

Numerous compounds were tried and at first minor difficulties were experienced, but the satisfactory spray painting of rubber bales has now been standard Socfin practice for several years.

Preparation of Baling Compound—The composition of the bale coating material is as follows:

Talc — I.C.I. best grade	...	48 lb
Mineral turpentine	...	7 gallons
Rubber solution	...	40 lb
Teepol	...	1 lb

The rubber solution consists of 1 lb of light coloured sheet or crepe rubber in 3 gallons of mineral turpentine. The specific gravity of the solvent is taken as 0.8 and 40 lb of solution are made by dissolving 1.6 lb of rubber in 4.8 gallons of mineral turpentine. Preparation is in two stages. The crepe is first cut into relatively thin slips, then mixed with 3 gallons of the turpentine. The mixture is allowed to stand for 24 hours. The remaining 1.8 gallons are then added, and stirring is continued until the rubber is completely dissolved and the mass is homogeneous.

To complete the preparation of the paint, 1 lb of Teepol is added to 4 gallons of mineral turpentine, and into this 48 lb of talc powder are added slowly with thorough mixing. The 40 lb of rubber solution are then stirred in, and the mixture is passed three times through a colloid mill. After this milling, the remaining three gallons of turpentine are added with thorough stirring and the painting compound is then complete.

It has been found convenient to centralise the preparation of baling solutions on one estate, from which distribution is made in small drums to others as and when required. *Figure 1* shows a general view of the plant used to prepare the suspension. It is equipped with a Hurrel homogeniser which operates with a gap clearance set at 0.004 inch. Hurrel homogenisers are made in several sizes according to the output required; we have found the smallest, i.e. the laboratory machine (*Figure 2*), to be quite adequate to cope easily with all our requirements.

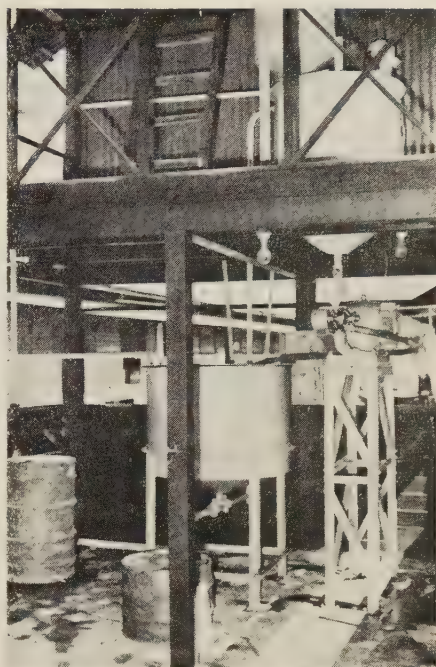


Figure 1. Plant for making the paint.

METHOD OF USE

Air Supply—The compressed air supply should be at a pressure of not less than 50 lb per square inch. It is essential that the filters in the air line are in proper working order, and no condensed moisture, grit or oil reaches the spray gun. Air consumption is approximately 3 cubic feet of free air per minute per spray gun.

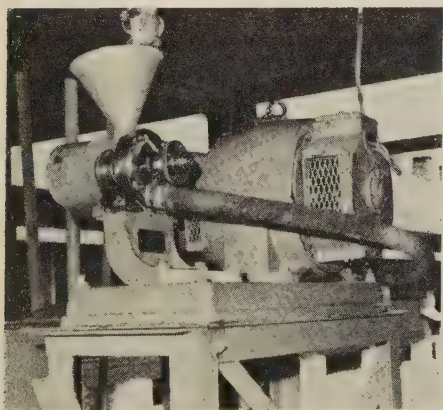


Figure 2. Hurrel homogeniser.

Spray Guns—Our experiments have shown that when spray guns are fed with bale paint from a large separate container, a certain amount of solids settle in the feed pipes between container and gun. This makes the use of a separate container



Figure 3. Spray gun.



Figure 4. Spray painting booth.



Figure 5. Booth and conveyor system.

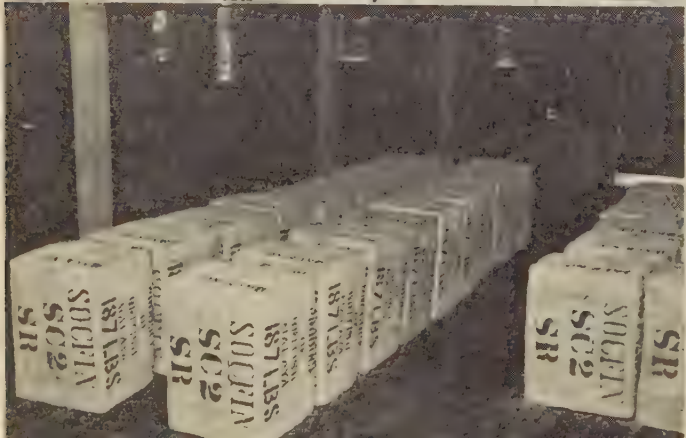


Figure 6. Lower grade crepe bales, spray painted.

Spray Painting Bales

impracticable, but we find guns of the type which have a quart container attached to the gun itself to be quite satisfactory (*Figure 3*). One filling of the container should be enough to give a smooth even coating over three bales.

Operation of Guns—Movement of the operator's hand generally keeps the contents of the container in sufficient agitation to prevent sedimentation of the solid talc. There is an adjusting screw on most spray guns by which control on the quantity of sprayed liquid can be maintained. This screw must be set so that the liquid emerges from the gun in the form of a very fine and even spray. If the adjustment is opened too much a fine spray cannot be maintained, and the result will be uneven coating on the bale and a large wastage of compound.

Before refilling the quart container it is essential that the contents of bulk supply tank be given a rapid stirring to homogenise them.

Cleaning of Guns—Spray guns should be thoroughly cleaned immediately after use. They cannot be laid down for an hour or so and then picked up and used again; the dried talc particles would choke the tiny apertures in the jets and prevent a fine even spray. Cleaning is extremely quick and simple with petrol or turpentine but care should be taken to ensure that the cleaning fluid does not get onto the air valve gland, because it would dissolve the lubricant. Only the jet, the short length of suction pipe, and the container, require cleaning.

Practical Application—The interior surfaces of press box units on to which talc had formerly to be dusted, to avoid difficulties in removing the pressed bale from the box, are now given an occasional spraying. All loose talc has thus been eliminated from the packing plant.

The spray painting of the bales is carried out in small well ventilated booths, separate from the packing section proper and usually sited against one wall of the packing shed. *Figures 4* and *5* show the operation of a conveyor system installed on one of our larger estates. When the quantity of rubber prepared daily is small such an installation is not warranted, but for large amounts it permits easy and rapid treatment to several bales at a time. By isolating the spray painting it is possible to keep walls, ceilings and floors of the packing section in good order and properly clean.



Figure 6 shows spray painted bales ready for despatch from an estate, and *Figure 7* shows all kinds of rubber awaiting shipment at the Socfin installation at Port Swettenham.

Figure 7. Spray painted bales in port godown.

R. R. I. News

Amendment II to the 'Type Descriptions and Packing Specifications for Natural Rubber' adopted by The Rubber Manufacturers Association and endorsed by the Rubber Trade Association of New York provides an alternative method of packing flat bark crepe. We have sent this amendment to all who have applied to us for copies of the original booklet. Further copies are available on request.

Partly Purified Rubbers

Enquiries have been made by several companies, who are interested in partially purified rubber for two main purposes. First, a material low in non-rubber constituents was required to avoid turbidity in the rubber derivative prepared from it. Second, a more highly purified material having low water absorption in the vulcanised state was aimed at, for electric cables. Several methods of purification have been examined including centrifuging, digestion with enzymes and bacteria, alkali treatment, soaking of coagulum and coagulation at low dry rubber content.

Consumer evaluation of the first type of material was followed by requests for some five tons for full scale factory trials. Should these prove successful then production by a suitable commercial estate could commence, the process comprising coagulation of centrifuged latex diluted to a d.r.c of 5%, followed by creping and drying as usual.

Work on the second type of purified crepe has been complicated by oxidation of the rubber,

which follows any advanced degree of purification by the processes tried. Centrifuging resulted in low ash, and trypsin treatment in low nitrogen content, as would be expected, but the water absorption of rubbers produced by these two processes was approximately the same. Combination of the two processes gave a somewhat lower water absorption but the rubber rapidly became sticky, making commercial handling impracticable. Some times the water absorption of the rubber was at a minimum when the d.r.c. of coagulation was between 10 and 15%. Storage of preserved latex for some weeks before coagulation produced a rubber of lower water absorption.

Experimental quantities of rubbers purified by these different processes are undergoing evaluation in the United Kingdom.

Rubber Lignin Masterbatch

Problems regarding preparation of the masterbatch have been solved in the laboratory and a pilot plant is now in operation, producing hundredweight quantities. The plant is used to obtain basic technical and economic data for the design of efficient commercial scale plant.

We have also studied the problem of controlling the final properties of the vulcanised compound. Two kinds of vulcanised lignin compound can be made from the masterbatch. In one type the lignin gives hard vulcanised compounds, which are useful for such products as shoe soleings, whilst the other type is soft and should be of value in tyre casings and sidewalls where resilience combined with good physical properties is important.

Combinations of desirable properties can be obtained which are not at present available to the rubber compounder.

We have shown that a hard product results when the lignin compound contains 5 to 10% of water, the hardening action being attributed to the formation of a lignin resin closely entangled with, but not chemically combined with, the vulcanised rubber structure. Certain chemicals (containing amino or hydroxy groups) are also effective. Hard compounds can be produced at will in the laboratory but in its present form the process is unsatisfactory in the factory.

If the water content is reduced to a low level, soft compounds are produced but compounding requirements for good vulcanisation then become abnormal. This has made it necessary to investigate the effect of different accelerators and activators from those normally used. As an activator lead oxide is preferred to the normal zinc oxide; stearic acid retards vulcanisation, whilst special accelerators such as lead derivatives of accelerators are required for the best results.

Compounding and preparational research continue.

Graft Rubbers

Graft polymers represent a new approach to the construction of modified rubbers. The method consists in growing branches of synthetic polymers on the trunk chain of the rubber molecule with the aim of adding the special properties of the polymer to the normal properties of natural rubber. The pioneer work in this field was carried out at the laboratories of the British Rubber Producers' Research Association

in England and the practical methods of making graft rubbers both from preserved latex concentrate and dry rubber were worked out. The laboratories of the synthetic rubber producers are keenly aware of the possibilities of modifying synthetic rubber in this manner. Our task was to determine whether the methods needed modification before they could be applied to freshly prepared latex in Malaya, and how the cost of production in the two countries compared.

Rubber methyl methacrylate graft — A simple method of preparation has now been developed for this graft, which would permit production in most Malayan estate factories. The chief problem was that of coagulating the rubber polymer latex to give a coherent coagulum instead of discreet flocculent particles. Careful control of coagulating conditions (chiefly pH, dilution and ionic strength) enables coagulum to be obtained which can be sheeted on a creping mill without undue trouble. Batches of 150 lb of grafts containing 30% and 50% methacrylate have been successfully prepared. The products prepared in Malaya were little different in composition or in technological properties from those prepared in England.

Graft rubber preparations are a mixture of free rubber, free polymer and true graft rubber. Milling alters the proportions of these constituents. We are seeking the optimum proportions.

Rubber styrene graft — Simple methods have been established for preparing this graft rubber in estate factories. The reaction takes place readily at tropical temperatures whereas in England the latex has to be heated. Coagulation is straightforward, contrary to English experience. The Malayan preparations resemble

English ones in the technological properties of vulcanisates.

Rubber acrylic acid grafts — Latex coagulates when acrylic acid is added, so our first step was to develop a suitable stabiliser. The products so far contain appreciable amounts of unchanged free rubber and we seek to improve the yield of graft. Special ingredients are required to vulcanise acrylic acid graft. The vulcanisates show improved oil resistance.

Rubber methacrylic acid graft — Even more effective stabilisation of the latex is necessary to enable methacrylic acid to be grafted to rubber. The properties of the graft are similar to that of acrylic acid and the vulcanisates show improved oil resistance.

S P Rubber

Superior Processing rubber is an intimate mixture of vulcanised and unvulcanised rubber and an essential part of its production is the mixing of the two ingredients in the latex stage prior to coagulation. Such rubbers have superior processing properties which enable complicated extrusions to be prepared more rapidly and more precisely than was possible with ordinary rubber.

Considerable demand for trial quantities of S P rubber has been received from the United Kingdom, U.S.A., Australia, and Malaya. During 1955 these requirements were fulfilled from 23 tons produced at our Experiment Station. Late in the year commercial production under licence from our Board was undertaken by one company. All reports show that the technical behaviour is satisfactory; one manufacturer reduced the amount of rejects in a complicated extru-

sion from 30% to 2% when he changed to S P rubber.

Production so far has been in the form of pale crepe carefully packed in polythene lined multi-wall paper bags. Thus it has been a speciality rubber, and the necessary price differential over RSS 1 has restricted its use to the field of pale crepe. We are now preparing at our factory hundredweight quantities of S P rubber in the form of smoked sheet for distribution as samples to British manufacturers. S P sheet rubber sent bareback will only require a small premium over RSS 1 (about 1d per lb) and in view of the interest already shown by consumers considerable quantities may be needed.

We also intend to produce an air dried S P sheet.

Cyclised Rubber

The main experimental work on the cyclised rubber masterbatch process, using skim latex to coagulate with cyclised latex, was completed before 1955. One producer had already made considerable quantities of masterbatch and continues to do so. Four other producers essayed production in 1955, but have since discontinued. A total export from Malaya of 55 tons was achieved for the year. This was not unexpected in view of the high rubber price prevailing, which forced the cost of cyclised rubber masterbatch up to about one and a half times that of the competing synthetic rubber. In 1956, with a lower rubber price, the production rate has doubled.

We have provided advice and help at the producers' factories, and tested samples of cyclised rubber masterbatches from all producers for quality control.

R. R. I. Lectures to Planters

A revised list of lectures available during the latter half of 1956 follows. Early application is recommended and an alternative choice should be given, to avoid disappointment. No lectures can now be arranged to take place before August.

BOTANICAL DIVISION

C.W. BROOKSON (until November) : *Breeding and selection of hevea*

P. DE JONGE : *Stimulation and tapping of young and old rubber*

PATHOLOGICAL DIVISION

R.A. FOX : *Root diseases*

R.N. HILTON (evening only) : *Pink disease*

A. NEWSAM : *Recognition of pests*

CHEMICAL DIVISION

G.W. DRAKE : *Anticoagulants*

D.J. GRAHAM : *Importance of cleanliness in latex concentrate production*

H.M. EDMONDSON : *Modified rubbers*

Planters' Bulletin—Vernacular Editions

When you send back the form enclosed in this issue, please don't forget to include the needs of all your assistants and senior conductors! Only if we have evidence of a sufficient demand can we undertake publication of one or more vernacular editions.

OUR COVER SHOWS A GIANT COLONY OF BACTERIA. ONE PARENT CELL, FROM A SAMPLE OF AMMONIATED LATEX, GAVE RISE TO THIS ORGANISED STRUCTURE OF MANY MILLIONS OF CELLS. THE APPEARANCE OF SUCH COLONIES IN FACTORY SPECIMENS ALLOWS DIFFERENT STRAINS TO BE RECOGNISED, AND SITES OF INFECTION TO BE IDENTIFIED IN THE FACTORY.

The new designs of the Royal Arms and of the garter badge, for use in the publications of Her Majesty's Stationery Office, are by Mr Reynolds Stone, who designed the colophon which appears on the front of Planters' Bulletin.

